



## **McNett Corp. – Aqua Mira® Water Treatment**

www.mcnett.com

### **Device Information**

The McNett Aqua Mira water treatment drops produce chlorine dioxide, a disinfectant. The drops are marketed as a treatment to kill odor-causing bacteria and enhance the taste of stored potable water. The device comes in two separate 30 mL bottles. One bottle, labeled Part A, contains a 2% sodium chlorite solution. The second bottle, labeled Part B, contains a 5% phosphoric acid solution. Chlorine dioxide is generated when these two solutions are mixed together. The manufacturer's directions require the user to place 7 drops of Part A (sodium chlorite) and 7 drops of Part B (phosphoric acid) in the provided mixing cap. Fifteen drops should be added if water is cloudy or tinted. Allow 5 minutes for the mixture to react (generate chlorine dioxide). Then add the mixture to 1 L of water, shake to mix, and let stand 15 minutes. If water is very cold, cloudy, or tinted let stand 30 minutes. Based on the assumption that 1 drop equals 0.05 ml, 7 drops of Part A and Part B added to 1 L of water results in an approximate chlorine dioxide dose of 3.5 mg/L. Fifteen drops of each part added to 1 L of water results in an approximate chlorine dioxide dose of 7.5 mg/L. The drops generate chlorine dioxide by reacting the sodium chlorite with phosphoric acid. The manufacturer recommends storing Aqua Mira away from heat and sunlight to prevent reduced effectiveness. For long periods of storage, Aqua Mira should be refrigerated, but do not freeze.

### **Effectiveness Against Microbial Pathogens**

No test data is available for the Aqua Mira drops using the U.S. Environmental Protection Agency (USEPA) Guide Standard and Protocol for Testing Microbiological Water Purifiers (reference 1). There is a significant amount of research on chlorine dioxide water disinfection and is summarized in reference 2. In the absence of testing data specific to this device and based on available research the McNett Aqua Mira drops should be capable of consistently reducing bacteria, viruses, and *Giardia* cysts to the required minimum log reductions stated in reference 1 (i.e., 6-log bacteria, 4-log virus, and 3-log *Giardia* cyst reduction). When used as directed, the dose and wait time correspond to a disinfectant concentration times contact time (CT) of approximately 53 mg-min/L for clear, warm waters. For cloudy or cold waters, the directions require higher dose and longer wait time resulting in a CT of approximately 225 mg-min/L. When used as directed, the resulting CTs should be more than adequate to consistently provide a 6-log bacteria, 4-log virus, and 3-log *Giardia* cyst reduction. When used as directed, this device

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® Aqua Mira is a registered trademark of McNETT Corporation, Bellingham, WA. Use of trademarked names does not imply endorsement by the U.S. Army, but is intended only in identification of a specific product.

will not consistently provide a 3-log reduction of *Cryptosporidium* oocysts. The USEPA proposed significantly higher CTs for a 3-log reduction of *Cryptosporidium* oocysts using chlorine dioxide. For 5° C water, the USEPA recommends a CT of 1286 mg-min/L. These higher CT values are based on numerous chlorine dioxide disinfection experiments and take into account the variability and uncertainty of the data (reference 3). Using the instructed dosage for cloudy or cold waters and extending the wait time to a minimum of 3 hours, resulting in an approximate CT of 1350 mg-min/L, would help ensure adequate reduction of *Cryptosporidium* oocysts. Waters less than 5° C would require even longer wait times, up to 4.5 hours. Based on general chlorine dioxide disinfection studies, the McNett Aqua Mira drops are given one √ each for bacteria, viruses, and *Giardia* cysts, and an X for *Cryptosporidium* oocysts (for an explanation of the rating checks [click here](#)). The following table summarizes McNett's Aqua Mira drops expected performance, evaluation rating, and the mechanism by which pathogens are inactivated:

**Table. Expected Performance Against Microbial Pathogens When Used as Directed.**

Microbial Pathogen Type	Expected Disinfection Capability	Evaluation Rating	Inactivation/removal Mechanism
Bacteria	> 6-log	√	Disinfection
Viruses	> 4-log	√	Disinfection
<i>Giardia</i> cysts	> 3-log	√	Disinfection
<i>Cryptosporidium</i> oocysts	Not Effective	X*	-

\* Recommend using the instructed dosage for cloudy or cold waters and extending the wait time to a minimum of 3 hours to help ensure adequate *Cryptosporidium* oocyst reduction. Waters less than 5° C would need an even longer wait time, up to 4.5 hours.

### Production Capacity

One package of McNett's Aqua Mira drops reportedly treats up to 120 liters. However, based on a volume of 30 ml per bottle and a dose of 7 or 15 drops (assuming 1 drop = 0.05 ml) per bottle for each liter of water treated, this corresponds to a production capacity of 40-90 liters.

### Cleaning, Replacement, End of Life Indicator, Shelf Life

The device has an expiration date. The manufacturer recommends using Aqua Mira before the expiration date. However, the date of production is not indicated, therefore, storage life cannot be determined. Based on the device's expiration date and the date of purchase, it can be assumed that the minimum shelf life is 4 years.



### Weight and Size

The total weight of both bottles is approximately 90 grams. The approximate dimensions of both bottles combined are 8 cm x 5.5 cm x 2.5 cm (H x L x W).

### Cost

The device cost about \$15.00.

### Device Evaluation

No data testing the McNett Aqua Mira drops was available. Research conducted on chlorine dioxide disinfection indicates that this device should be capable of consistently reducing bacteria, viruses, and *Giardia* cysts when used as directed. This device is not capable of consistently reducing *Cryptosporidium* oocysts when used as directed. Using the directed dose for cloudy or cold waters and extending the wait time to a minimum of 3 hours should ensure adequate *Cryptosporidium* oocyst reduction. Waters colder than 5° C would require even longer wait time. Also, additional treatment such as a 1 µm absolute filter can adequately reduce *Cryptosporidium* oocysts. Both water temperature and cloudiness (turbidity) can't often be measured in the field and requires user subjectivity. In these situations, a conservative approach is recommended and treating water according to directions for cloudy or cold water should adequately protect the soldier from bacteria, viruses, and *Giardia* cysts. These drops generate chlorine dioxide and will also produce chlorite, a byproduct of chlorine dioxide. Chlorite is present as a result of incomplete generation of chlorine dioxide as well as the conversion of chlorine dioxide to chlorite when reacting with organic matter in water (reference 2). Chlorine dioxide and chlorite can have serious adverse health effects for children, infants, and fetuses as a result of short-term exposure. But, no adverse health effects are expected for healthy adult individuals using this product for short periods of time and at manufacturer recommended dosages.

### Advantages

- Expect consistent protection from bacteria, viruses, and *Giardia* cysts when used as directed.
- Very small and lightweight.
- Simple and inexpensive to use.
- No adverse health effects expected in healthy adults from short-term use.



### Disadvantages

- Not consistently effective against *Cryptosporidium* oocysts when used as directed. Extending wait time up to 4.5 hours will help ensure adequate *Cryptosporidium* oocyst reduction.
- Does not reduce or remove particulate matter.
- Requires user subjectivity with respect to water temperature and cloudiness.
- May cause adverse health effects in children, infants, and fetuses from short-term use.

### References

1. USEPA, Registration Division Office of Pesticide Program, Criteria and Standards Division Office of Drinking Water. (1987). *Guide Standard and Protocol for Testing Microbiological Water Purifiers*. Washington, D.C.
2. U.S. Army Center for Health Promotion and Preventive Medicine. (2005). *Technical Information Paper; Chlorine Dioxide Disinfection in the Use of Individual Water Purification Devices*, Aberdeen Proving Ground, MD.
3. Federal Register (2003). *National Primary Drinking Water Regulations: Long Term 2 Enhanced Surface Water Treatment Rule; Proposed Rule*. 68(154), 47640-47795.

